

PART ONE - GENERAL

1.1 SECTION INCLUDES

1.1.1 REQUIREMENTS FOR WORK WITHIN THE RAILROAD RIGHTS-OF-WAY.

1.2 SYSTEM DESCRIPTION

1.2.1 WORK WITHIN THE RAILROAD RIGHTS-OF-WAY

1.2.1.1 ALL ACCESS AND WORK WITHIN THE RAILROAD RIGHTS-OF-WAY SHALL BE IN STRICT CONFORMANCE WITH CONSOLIDATED RAIL CORPORATION (CONRAIL) AND NEW JERSEY TRANSIT (NJT) REQUIREMENTS.

1.2.1.2 THE CASING PIPE INSTALLATION METHOD NOTED ON THE DRAWINGS AND THE SPECIFICATION SHALL NOT BE DEVIATED FROM BY THE CONTRACTOR WITHOUT APPROVAL OF THE AUTHORITY, NJT AND CONRAIL.

1.2.1.3 THE DESIGN OF THE JACKING AND RECEIVING PITS INCLUDING THE SHEETING SHALL BE PREPARED AND SUBMITTED BY THE CONTRACTOR TO NJT, CONRAIL IN ACCORDANCE WITH THE NJT AND CONRAIL REQUIREMENTS AND THE REQUIREMENTS OF THESE SPECIFICATIONS. NJT'S AND CONRAIL'S APPROVAL IS REQUIRED PRIOR TO BEGINNING ANY WORK ON OR WHICH MAY AFFECT NJT AND CONRAIL PROPERTY.

1.2.1.4 CASING PIPES OF A GREATER DESIGN THAN THAT SHOWN AS REQUIRED BY THE CONTRACTOR'S METHODS MUST BE APPROVED BY NJT AND CONRAIL PRIOR TO USE AND SHALL BE INSTALLED AT NO ADDITIONAL COST TO THE AUTHORITY.

PART ONE - GENERAL

1.1 SECTION INCLUDES

1.1.1 REQUIREMENTS FOR PROVIDING PRECAST CONCRETE MANHOLES.

1.2 SYSTEM DESCRIPTION

1.2.1 UNLESS OTHERWISE SHOWN ON THE DRAWINGS OR REQUIRED BY FIELD CONDITIONS AND APPROVED BY THE ENGINEER, ALL MANHOLES AND DROP MANHOLES SHALL BE PRECAST AND MANUFACTURED USING WET-CAST METHODS ONLY.

1.2.2 DROP MANHOLES SHALL BE CONSTRUCTED AS SHOWN ON THE DRAWINGS WHERE THE VERTICAL DISTANCE BETWEEN THE ELEVATION OF THE INVERT OF INCOMING PIPE AND THE INVERT OF THE OUTGOING PIPE IS TWO FEET OR GREATER.

1.2.3 INTERCONNECTING PIPES, INCLUDING THE MAIN RUN OF A DROP CONNECTION, SHALL NOT ENTER IN THE REDUCED DIAMETER PORTION OF THE MANHOLES. THE MANHOLES SHALL HAVE A BASE SECTION AND RISER(S) OF SUFFICIENT OVERALL HEIGHT TO ALLOW ALL INTERCONNECTING PIPE TO ENTER THE MANHOLE AT THE MANHOLE'S FULL NOMINAL DIAMETER UNLESS OTHERWISE SHOWN ON THE DRAWINGS.

1.2.3.1 THE MINIMUM HEIGHT OF THE FULL DIAMETER PORTION OF THE MANHOLE SHALL BE EQUAL TO THE FULL NOMINAL DIAMETER.

1.2.4 MANHOLES, SLABS, AND CASTINGS SHALL BE DESIGNED FOR AASHTO H-20 LOADING (MINIMUM).

1.2.5 FLOW CHANNELS SHALL BE CONSTRUCTED AS SHOWN ON THE DRAWINGS.

1.2.6 EXTERIOR SURFACES OF MANHOLES INCLUDING THE BOTTOM OF THE BASE SHALL BE COATED WITH A COAL TAR EPOXY WHERE SHOWN ON THE DRAWINGS.

1.2.7 INTERIOR MANHOLE COATING SHALL BE AS SPECIFIED HEREIN OR AS SHOWN ON THE DRAWINGS.

1.2.8 WHERE INDICATED ON THE DRAWINGS MANHOLES SHALL HAVE INTEGRALLY CAST CORROSION RESISTANT LINING WITH CORROSION RESISTANT ENTRY SLEEVE TO PROTECT THE GRADE RINGS. ENTRY SLEEVES SHALL ADDITIONALLY PROVIDE INFILTRATION/INFLOW PROTECTION TO THE JOINTS BETWEEN THE MANHOLE CASTING AND MANHOLE.

1.2.9 MANHOLE VENTS SHALL BE PROVIDED WHERE SHOWN ON THE DRAWINGS.

1.2.10 ACCESS INTO MANHOLES SHALL BE BY ALUMINUM OR REINFORCED PLASTIC STEPS OR ALUMINUM LADDER AS SHOWN ON THE DRAWINGS. WHEN

CORROSION RESISTANT LININGS ARE SPECIFIED THE REINFORCED PLASTIC STEPS SHALL BE USED.

1.2.11 FOR EACH TYPE OF MANHOLE COVER INSTALLED AND FOR EVERY FIFTY THEREAFTER, THE CONTRACTOR SHALL PROVIDE THE OWNER WITH ONE SET OF HOOKS, KEYS AND LIFTING DEVICES AS MAY BE REQUIRED BY THE TYPE OF COVER PROVIDED. A MINIMUM OF TWO SETS SHALL BE PROVIDED.

1.3 REFERENCES

1.3.1 ASTM A 48 - SPECIFICATIONS FOR GRAY IRON CASTINGS.

1.3.2 ASTM C 32 - SPECIFICATIONS FOR SEWER AND MANHOLE BRICK (MADE FROM CLAY OR SHALE) .

1.3.3 ASTM C 139 - SPECIFICATIONS FOR CONCRETE MASONRY UNITS FOR CONSTRUCTION OF CATCH BASINS AND MANHOLES.

1.3.4 ASTM C 140 - METHODS OF SAMPLING AND TESTING CONCRETE MASONRY UNITS.

1.3.5 ASTM C 207 - SPECIFICATIONS FOR HYDRATED LIME FOR MASONRY PURPOSES.

1.3.6 ASTM C 478 - SPECIFICATIONS FOR PRECAST REINFORCED CONCRETE MANHOLE SECTIONS.

1.3.7 ASTM C 923 - SPECIFICATIONS FOR RESILIENT CONNECTORS BETWEEN REINFORCED CONCRETE MANHOLE STRUCTURES AND PIPES.

1.3.8 NJDOT STANDARD SPECIFICATIONS

1.4 SUBMITTALS

1.4.1 SHOP DRAWINGS FOR MANHOLES SHALL INCLUDE, BUT NOT BE LIMITED TO, DETAILS ON JOINTS, REINFORCEMENT, STEPS OR LADDERS, VENTS, SLEEVES, PIPE CONNECTIONS, CASTING WEIGHTS AND DIMENSIONS, GRADE RINGS, LINERS AND ACCESSORIES AND CONSTRUCTION DETAILS.

PART TWO - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

2.1.1 CASTINGS SHALL BE AS FOLLOWS UNLESS SHOWN OTHERWISE ON THE DRAWINGS.

2.1.1.1 STANDARD MANHOLE FRAMES AND COVERS WITH CAMLOCK DEVICE SHALL BE PATTERN NO. 1460-B AS MANUFACTURED BY CAMPBELL FOUNDRY COMPANY; EQUIVALENT BY FLOCKHART FOUNDRY; OR EQUAL.

2.1.1.2 WATERTIGHT MANHOLE FRAMES AND BOLTED COVERS SHALL BE PATTERN NO. 1541 AS MANUFACTURED BY CAMPBELL FOUNDRY COMPANY; EQUIVALENT BY FLOCKHART FOUNDRY; OR EQUAL.

2.1.1.3 STANDARD SLAB TYPE MANHOLE FRAMES AND BOLTED COVERS SHALL BE PATTERN NO. 1516 TYPE "B" AS MANUFACTURED BY CAMPBELL FOUNDRY COMPANY; EQUIVALENT BY FLOCKHART COMPANY; OR EQUAL.

2.1.1.4 WATERTIGHT SLAB TYPE MANHOLE FRAMES AND BOLTED COVERS SHALL BE PATTERN NO. 1566 MODIFIED AS MANUFACTURED BY CAMPBELL FOUNDRY CO.; EQUIVALENT BY FLOCKHART FOUNDRY; OR EQUAL.

2.1.2 PRECAST CONCRETE MANHOLES SHALL BE AS MANUFACTURED BY ATLANTIC PRODUCTS COMPANY OR EQUAL.

2.1.3 COATINGS SHALL BE PRODUCTS OF CON-LUX COATINGS, INC., EDISON, N.J.; OR EQUAL.

2.1.4 FLEXIBLE PIPE CONNECTION SHALL BE A-LOC AS MANUFACTURED BY A-LOC PRODUCTS, INC., OR EQUAL.

2.1.5 CORROSION RESISTANT LINING SHALL BE DURA PLATE 100 AS MANUFACTURED BY A-LOC PRODUCTS, INC., OR EQUAL. ENTRY SLEEVE SHALL BE WATER-LOC CONNECTOR AS MANUFACTURED BY A-LOC PRODUCTS, INC., OR EQUAL.

2.2 MATERIALS

2.2.1 CASTINGS

2.2.1.1 CASTINGS FOR MANHOLE FRAMES AND COVERS SHALL BE CLOSE GRAINED, TOUGH GRAY IRON FREE FROM CRACKS, HOLES, SWELLS AND SHRINKAGE DISTORTION IN ACCORDANCE WITH ASTM A 48, CLASS 30B.

2.2.1.2 CROSS LOCK BAR FOR WATERTIGHT MANHOLE COVERS SHALL BE STEEL OR DUCTILE IRON WITH A BRONZE LOCK SCREW.

2.2.1.3 WATERTIGHT MANHOLE COVER GASKETS SHALL BE A 1/4-INCH FLAT NEOPRENE GASKET.

2.2.1.4 BOLTS FOR BOLTED MANHOLE COVERS SHALL BE STAINLESS STEEL.

2.2.1.5 CAM STYLE LOCKING DEVICE SHALL BE BRONZE.

2.2.2 MANHOLE STEPS

2.2.2.1 ALUMINUM MANHOLE STEPS SHALL BE EXTRUDED ALUMINUM 6061-T6 ALLOY.

2.2.2.2 REINFORCED PLASTIC MANHOLE STEPS SHALL BE POLYPROPYLENE PLASTIC BODY AROUND A GRADE 60 STEEL REINFORCEMENT BAR.

2.2.3 MANHOLE LADDERS

2.2.3.1 ALUMINUM LADDERS SHALL BE FABRICATED FROM TYPE 6061-T6 ALUMINUM ALLOY.

2.2.4 MANHOLES

2.2.4.1 PRECAST CONCRETE MANHOLES, BASES, RISERS, SLAB TOPS AND GRADE RINGS SHALL CONFORM TO THE REQUIREMENTS OF ASTM C 478. MAXIMUM ABSORPTION RATE SHALL NOT EXCEED 9 PERCENT USING METHOD A OF ASTM C 497.

2.2.4.2 CLASS "A" CONCRETE AND REINFORCING REQUIRED FOR CAST-IN-PLACE MANHOLES OR BASES SHALL CONFORM TO THE REQUIREMENTS OF SECTION 914 AND SUBSECTION 915.01 OF THE NJDOT STANDARD SPECIFICATIONS EXCEPT THAT TYPE II PORTLAND CEMENT SHALL BE USED.

2.2.4.3 CONCRETE REQUIRED FOR FORMING OF FLOW CHANNELS SHALL CONFORM TO THE REQUIREMENTS OF SECTION 914 OF THE NJDOT STANDARD SPECIFICATIONS FOR CLASS "A" CONCRETE.

2.2.4.4 CONCRETE FOR ENCASEMENT OF THE DROP PIPE ON DROP MANHOLES SHALL BE CLASS "B" AND CONFORM TO THE REQUIREMENTS OF SECTION 914 OF THE NJDOT STANDARD SPECIFICATIONS.

2.2.5 DROP PIPE

2.2.5.1 MATERIALS FOR THE DROP PIPE AND FITTINGS SHALL BE AS INDICATED ON THE DRAWINGS AND CONFORM TO THE REQUIREMENTS OF THEIR RESPECTIVE DIVISION 2 SECTIONS.

2.2.6 FLEXIBLE PIPE CONNECTIONS

2.2.6.1 FLEXIBLE WATERTIGHT PIPE CONNECTIONS SHALL CONFORM TO ASTM C 923.

2.2.7 BRICK

2.2.7.1 BRICK SHALL BE SOUND, HARD, AND UNIFORM BURNED BRICK AND SHALL BE GRADE MM IN CONFORMANCE WITH ASTM C 32.

2.2.8 MORTAR

2.2.8.1 MORTAR SHALL BE COMPOSED OF PORTLAND CEMENT, HYDRATED LIME, AND SAND. THE VOLUME OF SAND SHALL NOT BE LESS THAN TWO AND ONE HALF AND NOT MORE THAN THREE TIMES THE VOLUME OF CEMENT AND LIME. THE PROPORTION OF CEMENT TO LIME SHALL BE 1:1/4. THE QUALITY OF THE ITEMS SHALL BE:

- CEMENT SHALL BE TYPE II PORTLAND CEMENT.
- HYDRATED LIME SHALL BE TYPE S CONFORMING TO ASTM C 207.
- SAND SHALL CONFORM TO THE REQUIREMENTS OF SUBSECTION 901.13 OF THE NJDOT STANDARD SPECIFICATIONS.

2.2.9 COATINGS AND PAINTS SHALL BE AS SHOWN IN THE FOLLOWING SCHEDULE:

<u>SYSTEM</u>	<u>PRODUCT</u>
HI-BUILD EPOXY COATING	TANK-O-LON
COAL TAR EPOXY	EPOLON 22 BLACK MASTIC

2.2.10 CORROSION RESISTANT LINING SHALL BE PVC HAVING A MINIMUM THICKNESS OF 0.065 INCH.

2.2.11 VENTS

2.2.11.1 VENT PIPING SHALL BE DUCTILE IRON PIPE IN ACCORDANCE WITH ANSI A21.51 OR STEEL PIPE.

2.2.11.2 VENT CAP SHALL BE ALUMINUM WITH STAINLESS STEEL BIRD SCREEN.

2.3 FABRICATION

2.3.1 CASTINGS

2.3.1.1 CASTINGS SHALL BE MADE ACCURATELY TO THE MANUFACTURER'S PATTERNS AND TO THE DIMENSIONS AS SHOWN ON DRAWING WITH ALL BEARING SURFACES CAREFULLY MILL MACHINED.

2.3.1.2 ALLOWANCES SHALL BE MADE IN THE PATTERNS SO THAT THE SPECIFIED THICKNESS IS NOT REDUCED.

2.3.1.3 MANHOLE COVERS EXCEPT THOSE WITH CAM-LOCK DEVICES SHALL BE SUPPLIED WITH TWO WATERTIGHT PICK-HOLES.

2.3.1.4 MANHOLE COVERS SHALL BE SUPPLIED WITH CAST LETTERS AND COPE PATTERN AS SHOWN ON DRAWINGS. COPE PATTERN MUST BE APPROVED BY THE ENGINEER.

2.3.1.5 INNER COVER OF WATERTIGHT MANHOLE CASTINGS SHALL HAVE TWO LIFTING HANDLES.

2.3.1.6 ALL FRAMES EXCEPT SLAB TYPE SHALL HAVE FOUR CORED SLOTTED HOLES IN THE FLANGE EQUALLY SPACED.

2.3.1.7 FRAMES AND COVERS SHALL BE MATCH MARKED.

2.3.1.8 NO PLUGGING, BURNING-IN OR FILLING WILL BE ALLOWED.

2.3.2 ALUMINUM LADDERS

2.3.2.1 ALUMINUM LADDERS SHALL BE FABRICATED TO THE DIMENSIONS SHOWN ON THE DRAWINGS. ASSEMBLY SHALL BE BY WELDING.

2.3.3 STEPS

2.3.3.1 MANHOLE STEPS SHALL BE MADE TO THE SHAPES SHOWN ON THE DRAWINGS.

2.3.3.2 REINFORCED PLASTIC STEP SHALL HAVE A ONE-HALF INCH DIAMETER STEEL BAR ENCASED BY A POLYPROPYLENE PLASTIC BODY.

2.3.4 PRECAST MANHOLES

2.3.4.1 MANHOLE BASES, RISERS, CONES, AND SLABS SHALL BE MANUFACTURED TO THE DIMENSIONS AS SHOWN ON THE DRAWINGS AND SHALL BE MARKED IMMEDIATELY AFTER MANUFACTURE WITH DIAMETER, CLASS AND WALL THICKNESS, DATE OF MANUFACTURE, AND NAME OR TRADE MARK OF MANUFACTURER.

2.3.4.2 NO MORE THAN TWO INSERTS FOR LIFTING MAY BE CAST IN EACH SECTION.

2.3.4.3 JOINTS SHALL BE COMPATIBLE BETWEEN SECTIONS AND CONNECTIONS WITH PIPE.

2.3.4.4 FLEXIBLE WATERTIGHT PIPE CONNECTIONS SHALL BE CAST INTO ALL PIPE OPENINGS IN THE PRECAST MANHOLES AND SHALL BE CAPABLE OF DEFLECTING A MINIMUM OF 10 DEGREES. INSTALLATION SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S WRITTEN INSTRUCTIONS.

2.3.5 CORROSION RESISTANT LININGS

2.3.5.1 LINER SHALL BE PERMANENTLY AND MECHANICALLY ATTACHED TO EACH MANHOLE SECTION TO FORM A CONTINUOUS IMPERMEABLE LINING TO PROTECT THE PRECAST CONCRETE STRUCTURE FROM THE CORROSIVE INTERIOR ATMOSPHERE.

2.3.5.2 LINER SHALL RETURN INTO THE JOINTS BETWEEN MANHOLE SECTIONS FOR A MINIMUM OF THREE QUARTER INCHES. THE JOINT SHALL BE COMPLETED WITH A BUTYL-RUBBER JOINT MATERIAL OR EQUAL.

2.3.5.3 ENTRY SLEEVE SHALL BE CONSTRUCTED IN TWO PARTS TO PROVIDE FOR FIELD ADJUSTMENT. GASKETS BETWEEN PARTS SHALL BE NEOPRENE OR EQUAL FOR USE IN THE SEWER ENVIRONMENT. ATTACHMENT HARDWARE SHALL BE GALVANIZED STEEL IF CONCEALED AND STAINLESS STEEL IF EXPOSED.

2.3.6 VENT PIPES SHALL BE CLASS 53 IF DUCTILE IRON OR SCHEDULE 40 IF STEEL.

PART THREE - EXECUTION

3.1 INSPECTION

3.1.1 ALL COMPONENTS OF PRECAST MANHOLES, BLOCK, BRICK, LINERS AND CASTINGS SHALL BE INSPECTED FOR DEFECTS BEFORE INSTALLATION.

3.1.2 DAMAGED PIECES SHALL BE REPAIRED OR REPLACED IN ACCORDANCE WITH THE MANUFACTURER'S WRITTEN RECOMMENDATIONS, AS APPROVED BY THE ENGINEER.

3.1.3 DAMAGED PIECES THAT CANNOT BE REPAIRED SHALL BE IMMEDIATELY REMOVED FROM THE JOB SITE.

3.2 INSTALLATION

3.2.1 PRECAST MANHOLES

3.2.1.1 MANHOLE BASES SHALL BE INSTALLED ON A TWELVE-INCH COMPACTED BASE COURSE EXTENDING ONE FOOT BEYOND THE PERIFERY OF THE BASE AS SHOWN ON THE DRAWINGS.

3.2.1.2 MANHOLE SECTIONS SHALL BE SET VERTICAL AND WITH SECTIONS AND STEPS, IF USED, IN TRUE ALIGNMENT.

3.2.1.3 RUBBER GASKETS SHALL BE INSTALLED IN ALL JOINTS IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.

3.2.1.4 INSERTS FOR LIFTING SECTIONS SHALL BE THOROUGHLY PLUGGED WITH RUBBER PLUGS MADE SPECIFICALLY FOR THE SECTIONS AND WITH MORTAR. THE MORTAR, MADE OF ONE PART CEMENT TO ONE AND ONE HALF PART SAND AND MIXED SLIGHTLY DAMP TO THE TOUCH (JUST SHORT OF BALLING), SHALL BE HAMMERED INTO THE HOLES UNTIL IT IS DENSE AND AN EXCESS OF PASTE APPEARS ON THE SURFACE. FINISH SMOOTH AND FLUSH WITH THE ADJOINING SURFACES.

3.2.2 CAST-IN-PLACE MANHOLES OR DOGHOUSE MANHOLES

3.2.2.1 WHERE MANHOLES ARE INDICATED ON THE DRAWINGS TO BE CONSTRUCTED OVER EXISTING SEWERS, THE EXISTING SEWER PIPE SHALL BE LEFT INTACT AND THE FLOW MAINTAINED THROUGH IT UNTIL THE MANHOLE HAS BEEN COMPLETED AND ACCEPTED AND THE RECEIVING FACILITY TO WHERE THE FLOW IS BEING DIVERTED IS READY TO ACCEPT THE FLOW. THE CONTRACTOR SHALL PROPERLY SUPPORT AND CAREFULLY EXCAVATE AROUND THE EXISTING SEWER PIPE. UPON DIVERSION OF FLOW, THE TOP PORTION OF THE EXISTING SEWER PIPE SHALL BE CAREFULLY REMOVED AND THE FLOW CHANNEL FORMED TO THE LIMITS AND IN ACCORDANCE WITH THE DETAILS SHOWN ON THE DRAWINGS. EXPOSED PIPE STEEL REINFORCEMENT SHALL BE COVERED OVER WITH A MINIMUM OF ONE-HALF INCH OF MORTAR.

3.2.2.2 WHERE A CAST-IN-PLACE BASE SECTION IS USED THE TOP OF THE BASE SECTION SHALL HAVE A RING-FORMED JOINT CAST OR FORMED IN THE SECTION WHICH SHALL BE COMPATABLE WITH THE CORRESPONDING PRECAST MANHOLE RISER SECTIONS.

3.2.2.3 WHERE DOGHOUSE MANHOLES ARE USED THE BASE SLAB MAY BE CAST-IN-PLACE OR PRECAST AND SHALL HAVE REINFORCING BARS EXTENDING INTO THE CONCRETE FILL USED FOR THE FLOW CHANNEL AND BENCH TO PROVIDE FOR ANCHORAGE BETWEEN THE BASE SLAB AND BASE SECTION. THE DOGHOUSE MANHOLE SECTION SHALL HAVE OPENINGS PROVIDED BY THE MANUFACTURER TO FIT OVER THE EXISTING PIPE(S).

THE OPENING AROUND THE EXISTING PIPE(S) SHALL BE SEALED WITH CONCRETE WHEN FORMING THE FLOW CHANNEL TO THE TOP OF THE BENCH AND THE REMAINING OPENING ABOVE THE BENCH WITH CONCRETE OR BRICK AND MORTAR.

3.2.2.4 CAST-IN-PLACE CONCRETE AND REINFORCEMENT SHALL BE PLACED IN ACCORDANCE WITH THE APPLICABLE REQUIREMENTS OF SECTION 501 OF THE NJDOT STANDARD SPECIFICATIONS.

3.2.3 GROUNDWATER OBSERVATION PIPE

3.2.3.1 WHERE CALLED FOR ON THE DRAWINGS A THREE-QUARTER INCH DIAMETER THREADED GALVANIZED PIPE NIPPLE SHALL BE INSTALLED THROUGH THE MANHOLE WALL DIRECTLY ABOVE AND AS CLOSE AS POSSIBLE TO THE TOP OF OUTLET PIPE DURING MANHOLE FABRICATION. THE THREADED END OF THE NIPPLE SHALL EXTEND NO MORE THAN TWO INCHES ON THE INSIDE OF THE MANHOLE. THE TOTAL LENGTH OF THE NIPPLE SHALL EXCEED THE MANHOLE WALL THICKNESS BY NO LESS THAN FOUR INCHES. SPECIAL ATTENTION SHALL BE GIVEN TO PROVIDING A PERMANENT, WATERTIGHT SEAL AROUND THE PIPE NIPPLE AT THE MANHOLE WALL. THE PIPE NIPPLE SHALL BE SEALED INSIDE THE MANHOLE WITH A THREADED ONE-HALF INCH CAP. A MINIMUM OF 1 CUBIC FOOT OF CRUSHED STONE SHALL BE INSTALLED AROUND THE NIPPLE ON THE OUTSIDE OF THE MANHOLE.

3.2.4 MANHOLE FRAMES AND COVERS

3.2.4.1 FRAMES SHALL BE SET WITH THE TOPS CONFORMING ACCURATELY TO THE GRADE OF THE FINISHED PAVEMENT OR FINISHED GROUND SURFACE OR AS SHOWN ON THE DRAWINGS.

3.2.4.2 A MAXIMUM OF TWO COURSES OF BRICK SHALL BE USED TO ADJUST THE GRADE OF THE FRAMES. PRECAST GRADE RINGS ARE ACCEPTABLE.

3.2.4.3 FRAMES SHALL BE SET CONCENTRIC WITH THE TOP OF THE MASONRY AND IN A FULL BED OF MORTAR SO THAT THE SPACE BETWEEN THE TOP OF THE MANHOLE MASONRY AND THE BOTTOM FLANGE OF THE FRAME SHALL BE COMPLETELY FILLED AND WATERTIGHT.

3.2.4.4 MANHOLE FRAMES SHALL BE MECHANICALLY FASTENED TO THE MANHOLE BY MEANS OF 3/4" STAINLESS STEEL EXPANSION BOLTS THROUGH THE CORED SLOTTED HOLES IN THE FRAME FLANGE. FRAMES INSTALLED IN PAVED STREETS OR PARKING LOTS SHALL NOT BE BOLTED TO THE MANHOLES.

3.2.4.5 CASTINGS NOT INSTALLED IN PAVEMENT SHALL HAVE A THICK RING OF MORTAR EXTENDING TO THE OUTER EDGE OF THE MANHOLE PLACED ALL AROUND AND ON THE TOP OF THE BOTTOM FLANGE. THE MORTAR SHALL BE SMOOTHLY FINISHED AND HAVE A SLIGHT SLOPE TO SHED WATER AWAY FROM THE FRAME.

3.2.5 FLOW CHANNELS

3.2.5.1 AFTER THE MANHOLES HAVE BEEN BUILT TO THE PROPER HEIGHT AND ALL ADJACENT PIPE HAS BEEN INSTALLED, A CONCRETE FLOW CHANNEL SHALL BE FORMED AS SHOWN ON THE DRAWINGS. PRECAST CHANNELS MAY BE ALLOWED WITH THE ENGINEER'S APPROVAL.

3.2.6 PIPE CONNECTIONS

3.2.6.1 FLEXIBLE WATERTIGHT PIPE CONNECTIONS SHALL BE MADE IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.

3.2.6.2 THE VARIATION IN THE OUTSIDE DIAMETER OF THE CONNECTING PIPE(S) SHALL BE WITHIN THE LIMITS ALLOWED BY THE PIPE TO WALL CONNECTOR MANUFACTURER. CARE SHALL BE TAKEN TO AVOID DIAMETER DEFLECTION OF FLEXIBLE PIPES TO LIMITS BEYOND THE PIPE TO WALL CONNECTOR MANUFACTURER'S RECOMMENDATION FOR AFFECTING A WATERTIGHT SEAL.

3.2.6.3 WHERE UNUSED STUBS ON MANHOLES ARE SHOWN OT BE INSTALLED, THEIR LENGTH SHALL BE EQUAL TO THEIR NOMINAL DIAMETER OR 1.5 FEET WHICHEVER IS GREATER UNLESS OTHERWISE SHOWN. THE EXPOSED STUB END SHALL BE A PLAIN END WITH A PLUG TO MAKE THE STUB WATERTIGHT FROM ENTRANCE OF GROUNDWATER AND EXIST OF SEWAGE.

3.2.7 COATINGS

3.2.7.1 EXTERIOR COATING OF THE MANHOLE INCLUDING THE BOTTOM OF THE BASE SECTION SHALL BE TWO COATS OF A COAL TAR EPOXY. MINIMUM DRY FILM THICKNESS PER COAT SHALL BE 8 MILS.

3.2.7.2 ALL SURFACES OF THE CONCRETE FLOW CHANNEL AND INTERIOR WALLS OF THE MANHOLE BASE SECTION SHALL BE COATED WITH THREE COATS OF A COAL TAR EPOXY. MINIMUM DRY FILM THICKNESS PER COAT SHALL BE 8 MILS.

3.2.7.3 IF SHOWN ON THE DRAWINGS THE INTERIOR WALL SURFACES ABOVE THE MANHOLE BASE SECTION SHALL BE COATED WITH TWO COATS OF A HI-BUILD EPOXY. SECOND COAT SHALL BE LIGHT BLUE. MINIMUM DRY FILM THICKNESS PER COAT SHALL BE 5 MILS.

3.2.8 ALUMINUM LADDERS SHALL BE INSTALLED AFTER ALL SECTIONS ARE INSTALLED AND CHANNELS COMPLETED. LADDERS SHALL BE ATTACHED BY ALUMINUM BRACKETS SECURED BY STAINLESS STEEL EXPANSION BOLTS AND SHIELDS. LADDERS SHALL BE INSTALLED PLUMB AND PLACED SO THAT IT IS CENTERED UNDER THE ACCESS OPENING. ALUMINUM CONTACT AREAS TO CONCRETE SHALL BE COATED WITH AN ALKALI RESISTANT BITUMINOUS PAINT.

SECTION 02609

REINFORCED CONCRETE SANITARY SEWER STRUCTURES

PART ONE - GENERAL

1.1 SECTION INCLUDES

1.1.1 REQUIREMENTS FOR CONSTRUCTING REINFORCED CONCRETE STRUCTURES.

1.1.2 REQUIREMENTS FOR PRECAST CONCRETE MANHOLES AND INLETS ARE COVERED IN THEIR RESPECTIVE SPECIFICATION SECTIONS.

1.2 SYSTEM DESCRIPTION

1.2.1 STRUCTURES SPECIFIED IN THIS SECTION SHALL BE CONSTRUCTED TO THE GRADES AND DIMENSIONS SHOWN ON THE DRAWINGS. ORIENTATION AND ANGLE BETWEEN PIPE OPENINGS SHALL BE BASED ON CONTRACTOR'S PRECONSTRUCTION STAKEOUT AND/OR FIELD CONDITIONS.

1.2.2 REQUIREMENTS FOR EXCAVATION, BACKFILL, DEWATERING, PAVING, AND ALL APPURTENANT WORK ARE SPECIFIED IN OTHER SECTIONS OF THESE SPECIFICATIONS.

1.2.3 ALL CONCRETE WORK SHALL BE PROPORTIONED, PLACED AND FINISHED IN ACCORDANCE WITH CURRENT STANDARDS OF THE AMERICAN CONCRETE INSTITUTE "BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE" (ACI 318), "THE SPECIFICATION FOR STRUCTURAL CONCRETE FOR BUILDING" (ACI 301), AND AS SPECIFIED ELSEWHERE IN THESE SPECIFICATIONS AND ON THE DRAWINGS.

1.2.4 FLEXIBLE PIPE TO WALL CONNECTORS, WALL FITTINGS AND PIPE SUPPORTS SHALL BE AS SHOWN ON THE DRAWINGS. WALL FITTINGS SHALL BE CAST INTO THE WALLS AND BE COMPATIBLE WITH THE PIPE BEING USED. WALL SLEEVES SHALL HAVE A CENTER FLANGE TO FORM A WATERSTOP. TYPE OF FLEXIBLE PIPE TO WALL CONNECTORS SHALL BE AS INDICATED ON THE DRAWINGS.

1.2.5 EXTERIOR SURFACES OF STRUCTURES SHALL BE COATED AS SPECIFIED HEREIN OR SHOWN ON THE DRAWINGS.

1.2.6 WHERE SHOWN ON THE DRAWINGS INTERIORS OF STRUCTURES SHALL BE COATED, HAVE INTEGRALLY CAST CORROSION RESISTANT LINING OR HAVE SPECIAL MORTAR COATINGS.

1.2.7 THE CONTRACTOR MAY, AT HIS OPTION, HAVE THE STRUCTURES PRECAST BY A MANUFACTURER SPECIALIZING IN PRECAST REINFORCED CONCRETE STRUCTURES.

1.2.8 ACCESS INTO STRUCTURES SHALL BE BY ALUMINUM OR REINFORCED PLASTIC STEPS OR ALUMINUM LADDER AS SHOWN ON THE DRAWINGS. WHEN CORROSION RESISTANT LININGS OR SPECIAL MORTAR COATINGS ARE SPECIFIED THE REINFORCED PLASTIC STEPS SHALL BE USED.

1.3 SUBMITTALS

1.3.1 SHOP DRAWINGS FOR STRUCTURES SHALL INCLUDE, BUT NOT BE LIMITED TO, DETAILS ON JOINTS, REINFORCEMENT, STEPS OR LADDERS,

VENTS, WALL SLEEVES, PIPE CONNECTIONS, CASTING, BLOCK, MORTAR, CONSTRUCTION DETAILS AND DESIGN CALCULATIONS FOR TOP SLABS IF REQUIRED, SIGNED BY A LICENSED PROFESSIONAL ENGINEER.

1.3.2 WHERE THE DESIGN OF THE PRECAST STRUCTURE DIFFERS FROM THAT SHOWN ON THE DRAWINGS, THE DESIGN SHALL BE SUBMITTED SIGNED AND SEALED BY AN ENGINEER LICENSED IN THE STATE OF NEW JERSEY. THE INFORMATION SHALL INCLUDE, BUT NOT BE LIMITED TO, DESIGN CRITERIA, CALCULATIONS, FABRICATION DRAWINGS, AND DETAILS OF JOINTING OF SECTIONS.

PART TWO - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

2.1.1 PRECAST CONCRETE STRUCTURES SHALL BE BY OLDCASTLE PRECAST, INC. OR EQUAL.

2.1.2 CASTINGS SHALL BE AS MANUFACTURED BY CAMPBELL FOUNDRY COMPANY OR EQUAL.

2.1.3 COATINGS SHALL BE AS MANUFACTURED BY CON-LUX COATINGS, INC. OR EQUAL.

2.1.4 FLOOR DOORS AND FABRICATIONS SHALL BE AS MANUFACTURED BY BILCO; PURITAN MANUFACTURING CO.; NYSTROM PRODUCTS, CO. OR EQUAL.

2.1.5 SPECIAL MORTAR COATING SHALL BE STRONG SEAL MS-2 BY OSWALD ENTERPRISES; SEWPERCOAT BY LAFARGE CALCIUM ALUMINATES; OR EQUAL.

2.1.6 CORROSION RESISTANT LINING SHALL BE DURA PLATE 100 AS MANUFACTURED BY A-LOC PRODUCTS, INC., OR EQUAL. ENTRY SLEEVE SHALL BE WATER-LOC CONNECTOR AS MANUFACTURED BY A-LOC PRODUCTS, INC., OR EQUAL.

2.1.7 FLEXIBLE PIPE TO WALL CONNECTORS SHALL BE AS MANUFACTURED BY A-LOC PRODUCTS, INC. OR EQUAL.

2.2 MATERIALS

2.2.1 STRUCTURAL STEEL WORK SHALL CONFORM WITH THE LATEST AISC "SPECIFICATION FOR THE DESIGN, FABRICATION AND ERECTION OF STRUCTURAL STEEL FOR BUILDINGS".

2.2.2 STRUCTURAL STEEL SHALL BE ASTM A-36 HAVING A SPECIFIED MINIMUM YIELD POINT OF 36,000 PSI UNLESS NOTED.

2.2.3 BOLTS SHALL BE STAINLESS STEEL, AISI TYPE 302 OR HIGH STRENGTH STEEL IN ACCORDANCE WITH ASTM A-325 AS REQUIRED.

2.2.4 UNLESS OTHERWISE SHOWN, MINIMUM BOLT SIZE SHALL BE 3/4" DIAMETER; OPEN HOLES 1/16" GREATER THAN BOLT DIAMETER.

2.2.5 STRUCTURAL CONCRETE SHALL BE CLASS A WITH A MINIMUM ULTIMATE COMPRESSION STRENGTH OF 4,000 PSI AT 28 DAYS UNLESS OTHERWISE NOTED.

2.2.7 WELDED WIRE FABRIC (W.W.F.) SHALL COMPLY WITH ASTM A-185.

2.2.8 ALUMINUM FABRICATIONS SHALL BE TYPE 6061-T6 AND STRUCTURAL ALUMINUM SHAPES SHALL BE TYPE 6063-T5.

2.2.9 CORROSION RESISTANT LINING SHALL BE PVC HAVING A MINIMUM THICKNESS OF 0.065 INCH. THE LINER SHALL BE CAPABLE OF WITHSTANDING A MINIMUM TEST PULL OF 100 POUNDS PER LINEAR INCH.

2.2.10 REINFORCED PLASTIC MANHOLE STEPS SHALL BE POLYPROPYLENE PLASTIC BODY AROUND A GRADE 60 STEEL REINFORCEMENT BAR.

2.2.11 UNLESS OTHERWISE SHOWN ON THE DRAWINGS ALL INTERIOR PIPING AND FITTINGS SHALL BE CLASS 52 DUCTILE IRON AS SPECIFIED IN THE SECTION "DUCTILE IRON", DIVISION 2.

2.2.12 ALL VALVES AND APPURTENANCES SHALL CONFORM TO THEIR RESPECTIVE SPECIFICATION SECTIONS.

2.2.13 VENT PIPING SHALL BE CLASS 53 DUCTILE IRON OR SCHEDULE 40 STEEL AS INDICATED. VENT SHALL HAVE STAINLESS STEEL BIRD SCREEN.

2.2.14 PRECAST CONCRETE PLANKS SHALL CONFORM TO THE REQUIREMENTS OF THE SECTION "PRECAST CONCRETE PLANKS", DIVISION 2.

2.2.15 SPECIAL MORTAR COATING SHALL BE HIGH STRENGTH, WATERPROOF, AND CORROSION RESISTANT MORTAR MIXTURE FOR CORROSION PROTECTION OF CONCRETE SURFACES. SYSTEM SHALL BE ACCEPTABLE FOR USE IN SPLASH ZONE AND VAPOR EXPOSURE TO SULFURIC ACID (UP TO 20% CONCENTRATION).

2.1.16 FLEXIBLE PIPE TO WALL CONNECTORS SHALL BE MANUFACTURED IN ACCORDANCE WITH ASTM-C923 "RESILIENT CONNECTOR BETWEEN REINFORCED CONCRETE MANHOLE STRUCTURES AND PIPES". HARDWARE SHALL BE STAINLESS STEEL.

2.3 FABRICATION

2.3.1 ALL WELDING SHALL CONFORM TO THE REQUIREMENTS OF THE LATEST AMERICAN WELDING SOCIETY "STRUCTURAL WELDING CODE" AS APPLICABLE TO BUILDINGS.

2.3.2 BURNING OF HOLES, CUTS, ETC., IN STRUCTURAL STEEL MEMBERS IN THE FIELD WILL NOT BE PERMITTED, EXCEPT WITH THE SPECIFIC APPROVAL OF THE ENGINEER.

2.3.3 REINFORCED PLASTIC STEP SHALL HAVE A ONE-HALF INCH DIAMETER BAR ENCASED BY A POLYPROPYLENE PLASTIC BODY.

2.3.4 CORROSION RESISTANT LININGS

2.3.4.1 LINING SHALL BE PERMANENTLY AND MECHANICALLY ATTACHED TO FORM A CONTINUOUS IMPERMEABLE LINING TO PROTECT THE PRECAST CONCRETE STRUCTURE FROM THE CORROSIVE INTERIOR ATMOSPHERE.

2.3.4.2 LINER SHALL RETURN INTO THE JOINTS BETWEEN PRECAST SECTIONS FOR A MINIMUM OF THREE QUARTER INCHES. THE JOINT SHALL BE COMPLETED WITH A BUTYL-RUBBER JOINT MATERIAL OR EQUAL.

2.3.4.3 ENTRY SLEEVE SHALL BE CONSTRUCTED IN TWO PARTS TO PROVIDE FOR FIELD ADJUSTMENT. GASKETS BETWEEN PARTS SHALL BE NEOPRENE OR EQUAL FOR USE IN THE SEWER ENVIRONMENT. ATTACHMENT HARDWARE SHALL BE GALVANIZED STEEL IF CONCEALED AND STAINLESS STEEL IF EXPOSED.

2.3.5 THE WALL CONNECTION ON FLEXIBLE PIPE TO WALL CONNECTORS SHALL BE CAST INTO THE STRUCTURE WHENEVER PRACTICAL.

PART THREE - EXECUTION

3.1 INSPECTION

3.1.1 ALL COMPONENTS OF THE STRUCTURES SHALL BE INSPECTED FOR DEFECTS BEFORE INSTALLATION.

3.1.2 DAMAGED PIECES SHALL BE REPLACED OR REPAIRED IN ACCORDANCE WITH THE MANUFACTURER'S WRITTEN RECOMMENDATIONS.

3.1.3 DAMAGED PIECES THAT CANNOT BE REPAIRED SHALL BE IMMEDIATELY REMOVED FROM THE JOB SITE.

3.2 PREPARATION

3.2.1 EXCAVATIONS AND BACKFILLING SHALL BE PERFORMED IN ACCORDANCE WITH THE SPECIFICATIONS.

3.2.2 EXCAVATIONS SHALL BE KEPT DRY AND DEWATERED IN ACCORDANCE WITH THE SPECIFICATIONS.

3.3 EXECUTION

3.3.1 REINFORCING STEEL SHALL BE FURNISHED IN THE FULL LENGTHS AS INDICATED ON THE DRAWINGS UNLESS OTHERWISE APPROVED. SPLICING OF BARS, EXCEPT WHERE SHOWN ON THE DRAWINGS, WILL NOT BE PERMITTED WITHOUT WRITTEN APPROVAL. UNLESS OTHERWISE SHOWN, BARS SHALL BE LAPPED IN ACCORDANCE WITH THE CURRENT ACI STANDARDS.

3.3.2 CONSTRUCTION JOINTS SHALL BE THOROUGHLY CLEANED, WETTED AND SLUSHED WITH CEMENT GROUT JUST BEFORE PLACING NEW CONCRETE.

3.3.3 ALL CONCRETE WALLS WHICH WILL BE PERMANENTLY EXPOSED TO EARTH SHALL BE DAMP PROOFED AS SHOWN ON THE DRAWINGS AND IN ACCORDANCE WITH THE SPECIFICATIONS.

3.3.4 ALL DIMENSIONS AND ELEVATIONS SHALL BE VERIFIED BY THE CONTRACTOR. ANY DISCREPANCIES SHALL BE BROUGHT TO THE IMMEDIATE ATTENTION OF THE ENGINEER.

3.3.5 CONTINUOUSLY PROTECT THE BOTTOM OF THE EXCAVATION AND ALL SLABS AND FOUNDATIONS ON GROUND AND ALL EXISTING STRUCTURES FROM DAMAGE DUE TO FROST AND GROUND WATER PRESSURES.

3.3.6 WHERE ALUMINUM CONTACTS MASONRY OR CONCRETE, APPLY A HEAVY COAT OF ALKALI RESISTANT BITUMINOUS PAINT TO THE MASONRY OR CONCRETE. FOR ALUMINUM STEPS, APPLY PAINT TO THE STEPS.

3.3.7 COATINGS FOR STRUCTURES SHALL BE AS FOLLOWS:

3.3.7.1 INTERIOR SURFACES IN CHANNELS OR WELLS SHALL RECEIVE 2 COATS OF A COAL TAR EPOXY. REDUCE FIRST COAT 25% AND APPLY SUCCEEDING COATS WITHIN 24 HOURS. MINIMUM DRY MIL THICKNESS PER COAT SHALL BE 8 MILS.

3.3.7.2 INTERIOR FLOORS SHALL RECEIVE 2 COATS OF AN EPOXY FLOOR COATING. REDUCE FIRST COAT 25%. MINIMUM DRY FILM THICKNESS PER COAT SHALL BE 2 MILS.

3.3.7.3 INTERIOR WALLS AND UNDERSIDE OF ROOF SLAB SHALL RECEIVE 2 COATS OF A HIGH BUILD EPOXY. REDUCE FIRST COAT 25%. SECOND COAT SHALL BE LIGHT BLUE. MINIMUM DRY FILM THICKNESS PER COAT SHALL BE 5 MILS.

3.3.7.4 EXTERIOR COATING OF STRUCTURES IF SHOWN ON THE DRAWINGS SHALL BE TWO COATS OF A COAL TAR EPOXY. REDUCE FIRST COAT BY 25%. MINIMUM DRY FILM THICKNESS PER COAT SHALL BE 8 MILS.

3.3.7.5 INTERIOR PIPING, FITTINGS AND VALVES SHALL RECEIVE A FINISH COATING OF TWO COATS OF HIGH BUILD EPOXY, EACH COAT HAVING A MINIMUM DRY FILM THICKNESS OF 5 MILS. COLOR SHALL BE DARK BLUE.

3.3.7.6 VENT PIPING SHALL RECEIVE A FINISH COATING OF TWO COATS OF VINYL ENAMEL, EACH COATING HAVING A MINIMUM DRY FILM THICKNESS OF 2 MILS.

3.3.7.7 ALL COATINGS SHALL BE APPLIED IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS.

3.3.8 PROVIDE INTEGRALLY CAST CORROSION RESISTANT LINING WITH CORROSION RESISTANT ENTRY SLEEVE TO PROTECT THE GRADE RINGS. ENTRY SLEEVES SHALL ADDITIONALLY PROVIDE INFILTRATION/INFLOW PROTECTION TO THE JOINTS BETWEEN THE MANHOLE CASTING AND STRUCTURE.

3.3.8.1 WHEN CORROSION RESISTANT LININGS ARE CALLED FOR THE STRUCTURES WALLS, CEILING AND ENTRANCE WAY SHALL HAVE THE LINING INSTALLED. WALKING SURFACES AND FLOW CHANNELS SHALL HAVE SPECIAL MORTAR COATINGS APPLIED UNLESS SHOWN OTHERWISE.

3.3.9 SPECIAL MORTAR COATINGS SHALL BE APPLIED TO A MINIMUM OF 3/8 INCH THICKNESS OR AS RECOMMENDED BY THE MANUFACTURER, WHICHEVER IS GREATER.

3.3.10 THE VARIATION IN THE OUTSIDE DIAMETER OF THE CONNECTING PIPE(S) SHALL BE WITHIN THE LIMITS ALLOWED BY THE PIPE TO WALL CONNECTOR MANUFACTURER. CARE SHALL BE TAKEN TO AVOID DIAMETER DEFLECTION OF PIPES TO LIMITS BEYOND THE PIPE TO WALL CONNECTOR MANUFACTURER'S RECOMMENDATION FOR AFFECTING A WATERTIGHT SEAL.

PART ONE - GENERAL

1.1 SECTION INCLUDES

1.1.1 REQUIREMENTS FOR PROVIDING POLYVINYL CHLORIDE (PVC) GRAVITY SEWER PIPE AND FITTINGS.

1.2 SYSTEM DESCRIPTION

1.2.1 PIPE SHALL BE POLYVINYL CHLORIDE (PVC) SEWER PIPE WITH AN INTEGRAL BELL-AND-SPIGOT TYPE RUBBER GASKETED JOINT. EACH INTEGRAL BELL JOINT SHALL CONSIST OF A FORMED BELL COMPLETE WITH A SINGLE RUBBER GASKET. PIPE SHALL BE OF THE SIZE SHOWN ON THE DRAWINGS.

1.2.2 ALL FITTINGS SHALL UTILIZE RUBBER GASKETED JOINTS AND BE COMPATIBLE WITH THAT OF THE PIPE.

1.2.3 THE PIPE SHALL BE LOCATED AND INSTALLED TO THE LINES AND GRADES SHOWN ON THE DRAWINGS.

1.3 REFERENCES

1.3.1 ASTM D 1784 - SPECIFICATION FOR RIGID POLY(VINYL CHLORIDE) (PVC) COMPOUNDS AND CHLORINATED POLY(VINYL CHLORIDE) (CPVC) COMPOUNDS.

1.3.2 ASTM D 2321 - RECOMMENDED PRACTICE FOR UNDERGROUND INSTALLATION OF FLEXIBLE THERMOPLASTIC SEWER PIPE.

1.3.3 ASTM D 3034 - SPECIFICATION FOR TYPE PSM POLY(VINYL CHLORIDE) (PVC) SEWER PIPE AND FITTINGS.

1.3.4 ASTM D 3212 - SPECIFICATION FOR JOINTS FOR DRAIN AND SEWER PLASTIC PIPES USING FLEXIBLE ELASTOMERIC SEALS.

1.3.5 ASTM F 477 - SPECIFICATION FOR ELASTOMERIC SEALS (GASKETS) FOR JOINING PLASTIC PIPE.

1.3.6 ASTM F 679 - SPECIFICATION FOR POLY(VINYL CHLORIDE) (PVC) LARGE-DIAMETER PLASTIC GRAVITY SEWER PIPE AND FITTINGS.

1.3.7 ASTM F794 - SPECIFICATION FOR POLY (VINYL CHLORIDE) (PVC) PROFILE GRAVITY SEWER PIPE AND FITTINGS BASED ON CONTROLLED INSIDE DIAMETER.

1.3.8 ASTM F1803 - SPECIFICATION FOR POLY (VINYL CHLORIDE) (PVC) CLOSED PROFILE GRAVITY PIPE AND FITTINGS BASED ON CONTROLLED INSIDE DIAMETER.

1.4 SUBMITTALS

1.4.1 SHOP DRAWINGS SHALL BE SUBMITTED IN ACCORDANCE WITH THE SPECIFICATIONS.

PART TWO - PRODUCTS

2.1 MATERIALS

2.1.1 PIPE AND FITTINGS FROM 4 INCHES TO 15 INCHES SHALL COMPLY WITH ASTM D 3034 WITH A WALL THICKNESS DESIGNATION OF SDR 35 OR BE MANUFACTURED TO ASTM D 3034 OUTSIDE DIAMETERS AND HAVE A MINIMUM PIPE STIFFNESS OF 46 PSI. PIPE AND FITTINGS FROM 18 INCHES TO 27 INCHES SHALL COMPLY WITH ASTM F 679 AND SHALL HAVE A UNIFORM SOLID WALL THICKNESS. PIPE AND FITTINGS FROM 30 TO 60 INCHES IN DIAMETER SHALL BE CLOSED PROFILE WALL AND SHALL CONFORM TO ASTM F1803 AND A MINIMUM PIPE STIFFNESS OF 46 PSI.

2.1.2 JOINTS FOR PVC SEWER PIPE AND FITTINGS SHALL COMPLY WITH ASTM D 3212.

2.1.3 RUBBER GASKETS FOR JOINTS SHALL COMPLY WITH ASTM F 477.

PART THREE - EXECUTION

3.1 HANDLING AND STORAGE

3.1.1 HANDLE PIPE AND FITTINGS WITH CARE TO PREVENT DAMAGE. STORE PIPE ON FLAT SURFACES SO THE BARRELS ARE EVENLY SUPPORTED. IF MATERIALS ARE STORED OUTSIDE FOR EXTENDED PERIOD OF TIME, COVER WITH OPAQUE MATERIAL TO PROTECT FROM DIRECT SUNLIGHT.

3.2 JOINTING AND INSTALLATION

3.2.1 PIPE AND FITTINGS SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS AND AS SPECIFIED IN ASTM D 2321 AS MODIFIED HEREIN.

3.2.2 FIELD CUT PIPE SHALL HAVE SQUARE CUT ENDS. REMOVE BURRS INSIDE AND OUTSIDE OF PIPE. BEVEL OUTSIDE EDGE FOR INSERTION INTO THE GASKETED BELL TO MATCH THE FACTORY BEVEL AND MARK THE NEW FULL INSERTION DEPTH LINE.

3.2.3 PIPEBEDDING SHALL HAVE A MINIMUM THICKNESS OF 6 INCHES AND SHALL BE COMPACTED TO THE DENSITY SHOWN ON THE DRAWINGS. THE BEDDING SHALL BE SHAPED TO HAVE CONTACT WITH THE PIPE FOR AN ANGLE OF AT LEAST 90 DEGREES.

3.2.4 SUITABLE MATERIAL FOR PIPE EMBEDMENT SHALL BE PLACED AND COMPACTED IN THREE SUCCESSIVE COURSES.

3.2.5 HAUNCHING MATERIAL SHALL BE PLACED TO THE SPRING LINE OF THE PIPE AND COMPACTED BY HAND ADJACENT TO THE PIPE AND BY MECHANICAL TAMPERS ELSEWHERE. SUFFICIENT MATERIAL SHALL BE WORKED UNDER THE HAUNCH OF THE PIPE TO PROVIDE ADEQUATE SIDE SUPPORT.

PRECAUTIONS SHALL BE TAKEN TO PREVENT MOVEMENT OF THE PIPE DURING PLACEMENT OF THE HAUNCH.

3.2.6 MATERIAL FOR INITIAL BACKFILL SHALL BE AS SHOWN ON THE DRAWINGS. INITIAL BACKFILL SHALL BE PLACED IN TWO STAGES. THE FIRST STAGE SHALL BE TO THE TOP OF THE PIPE. THE SECOND STAGE SHALL BE TO A POINT AT LEAST 12 INCHES OVER THE TOP OF THE PIPE.

3.2.7 UPON COMPLETION OF PLACEMENT OF PIPE EMBEDMENT MATERIAL FOR EACH COURSE, THE MATERIAL SHALL BE COMPACTED TO THE DENSITIES SHOWN ON THE DRAWINGS. CONTACT BETWEEN THE PIPE AND THE COMPACTION EQUIPMENT SHALL BE AVOIDED.

3.2.8 DESPITE THE MAXIMUM PIPE DIAMETER DEFLECTION ALLOWED HEREIN, THE CONTRACTOR SHOULD BE AWARE OF THE DIAMETER DEFLECTION ALLOWED FOR CONNECTION OF THE PIPE TO STRUCTURES IN ORDER TO AVOID LEAKAGE THROUGH THE PIPE TO WALL SEALS.

3.3 TESTING

3.3.1 FOLLOWING INSTALLATION OF PIPE AND COMPLETION OF BACKFILL TO EXISTING GRADE, PIPE SHALL BE TESTED FOR DIAMETER DEFLECTION IN THE PRESENCE OF THE ENGINEER. OPTIONAL DEVICES FOR TESTING INCLUDE PROPERLY SIZED GO-NO-GO MANDRELL OR DEFLECTOMETER. MAXIMUM ALLOWABLE DEFLECTION SHALL BE FIVE PERCENT. ALL PIPES FOUND IN WHICH THE DEFLECTION EXCEEDS FIVE PERCENT SHALL BE UNCOVERED AND REINSTALLED AT NO ADDITIONAL EXPENSE TO THE OWNER.

3.3.2 INFILTRATION AND EXFILTRATION TESTING SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF THE SECTION "TESTING AND INSPECTION OF GRAVITY LINES", DIVISION 2.

PART ONE - GENERAL

1.1 SECTION INCLUDES

1.1.1 REQUIREMENTS DESCRIBING THE TESTING AND INSPECTION OF GRAVITY LINES.

1.2 SYSTEM DESCRIPTION

1.2.1 VISUAL INSPECTION

1.2.1.1 UPON COMPLETION OF THE INSTALLATION OF THE PIPE AND BACKFILLING AND COMPACTING OF THE TRENCH, THE PIPE SHALL BE VISUALLY INSPECTED. THIS INSPECTION SHALL BE UNDERTAKEN AS THE WORK PROGRESSES. THE ENGINEER SHALL BE NOTIFIED A WEEK IN ADVANCE OF SUCH INSPECTION AND THE CONTRACTOR SHALL PROVIDE ALL FACILITIES, MATERIALS, EQUIPMENT AND LABOR REQUIRED FOR SUCH INSPECTION.

1.2.1.2 ALL FOREIGN MATERIAL, DIRT, DEBRIS OR OTHER OBJECTS FOUND IN THE INTERIOR OF THE PIPE SHALL BE REMOVED BY THE CONTRACTOR. VISIBLE DEFECTS SUCH AS BROKEN PIPE SECTIONS, IMPROPERLY INSTALLED GASKETS, PROJECTING CONNECTIONS, CRACKS, VISIBLE LEAKS OR OTHER DEFECTS SHALL BE NOTED, CORRECTED AND THE PIPE REINSPECTED.

1.2.2 INFILTRATION/EXFILTRATION TESTING

1.2.2.1 THE ENGINEER SHALL BE NOTIFIED TWO WEEKS IN ADVANCE OF INFILTRATION/EXFILTRATION TESTING.

1.2.2.2 AN INFILTRATION TEST SHALL BE PERFORMED FOR THOSE LINES WHERE THE GROUND WATER LEVEL IS AT LEAST 2 FEET HIGHER THAN THE TOP OF THE PIPE AT THE UPSTREAM MANHOLE. WHERE GROUND WATER LEVEL IS LOWER THAN TWO FEET ABOVE THE TOP OF THE PIPE AT THE UPSTREAM MANHOLE, AN EXFILTRATION TEST SHALL BE PERFORMED. WATER TESTING OR AIR TESTING MAY BE USED FOR THE EXFILTRATION TEST.

1.2.2.3 RATE OF INFILTRATION OR EXFILTRATION SHALL NOT EXCEED ONE-HUNDERED GALLONS PER MILE PER INCH OF DIAMETER OF PIPE FOR 24 HOURS. AIR TEST ALLOWS MINIMUM AMOUNT OF TIME FOR AIR PRESSURE INSIDE PIPE TO DROP FROM 3.5 PSIG TO 2.5 PSIG; ALLOWABLE TIME IS A FUNCTION OF PIPE SIZE. THESE REQUIREMENTS WILL BE MET FOR EVERY TEST SECTION OF PIPE; IT IS NOT A CUMULATIVE AVERAGE OVER SEVERAL TEST SECTIONS OF PIPE. THE PHRASE "PER MILE" SHALL REFER TO THE TOTAL LENGTH OF MAIN SEWER, MEASURED THROUGH MANHOLES, PLUS THE LENGTHS OF ALL CONNECTIONS, LATERALS AND BRANCHES.

1.2.2.4 THE CONTRACTOR SHALL CONSTRUCT ALL BULKHEADS; PROVIDE WEIRS OR OTHER MEANS OF MEASUREMENT, PUMPS, WATER, PLUGS,

FITTINGS, METERS, LIGHTS, HOSES AND ALL ELSE NECESSARY FOR INSPECTION AND TESTINGS.

1.2.3 MINIMUM PIPE SLOPE

1.2.3.1 PIPES INSTALLED AT LESS THAN THE SLOPES SHOWN ON THE DRAWINGS SHALL BE RE-INSTALLED BY THE CONTRACTOR TO THE DESIGN SLOPE SHOWN OR THE CONTRACTOR SHALL DEMONSTRATE TO THE ENGINEER'S AND OWNER'S SATISFACTION THAT THE DESIGN CAPACITY AND VELOCITY CAN BE ACHIEVED.

1.2.4 DURING THE ONE YEAR CORRECTION PERIOD, THE SYSTEM OR ANY PART THEREOF, MAY BE REINSPECTED AND/OR RETESTED IF IT IS DETERMINED BY THE ENGINEER THAT DEFECTIVE MATERIALS OR UNSATISFACTORY WORK MAY EXIST, OR THAT EXCESSIVE LEAKAGE MAY BE OCCURRING. CONTRACTOR SHALL PERFORM THE REINSPECTION, RETESTING, REMOVAL AND REPLACEMENT OF DEFECTIVE WORK AT NO ADDITIONAL COST TO THE OWNER.

1.3 SUBMITTALS

1.3.1 CERTIFIED COPIES OF ALL TESTS AND FINAL INSPECTION REPORTS SHALL BE SUBMITTED TO THE ENGINEER.

PART THREE - EXECUTION

3.1 PREPARATION

3.1.1 THE PIPE SECTION BEING TESTED SHALL BE ENTIRELY FREE FROM ANY AND ALL DEBRIS, STONES, SAND AND ANY OTHER MATERIALS. WATER USED IN FLUSHING THE LINES SHALL NOT BE DISCHARGED INTO CLEAN SECTIONS OF PIPELINE OR ACTIVE SEWERS, BUT SHALL BE DISCHARGED AS SPECIFIED IN THE APPROPRIATE PARTS OF THE SECTION "DEWATERING". DISPOSAL OF DEBRIS AND ALL OTHER MATERIAL SHALL BE IN CONFORMANCE WITH THE REQUIREMENTS OF THE SPECIFICATIONS.

3.2 FIELD QUALITY CONTROL

3.2.1 THE FIRST SECTION OF PIPE (BETWEEN TWO MANHOLES) LAID BY EACH PIPE CREW WILL IMMEDIATELY BE TESTED UPON COMPLETION IN ORDER TO CHECK WORKMANSHIP.

3.2.2 LINES SHALL BE VISUALLY INSPECTED FROM MANHOLE TO MANHOLE BY THE ENGINEER. THE CONTRACTOR SHALL FURNISH TWO MEN TO ASSIST THE ENGINEER IN MAKING THE INSPECTION. IT IS A CONDITION OF ACCEPTANCE THAT ALL MANHOLES BE COMPLETE, THE PIPE BE CLEANED, AND ALL LINES BE LAID STRAIGHT FROM MANHOLE TO MANHOLE UNLESS OTHERWISE SHOWN ON THE DRAWINGS. ALL DEFECTS NOTED DURING THIS INSPECTION SHALL BE CORRECTED BY THE CONTRACTOR TO THE SATISFACTION OF THE ENGINEER. AFTER CORRECTION THE LINES SHALL BE REINSPECTED.

3.2.2.1 THE ENGINEER MAY SUBSTITUTE A CCTV INSPECTION OF THE LINES IN LIEU OF PERSONNEL PHYSICALLY ENTERING THE PIPELINES. THIS SHALL BE AT NO ADDITIONAL COST TO THE CONTRACTOR.

3.2.3 WHEN THE GRAVITY LINES HAVE BEEN SATISFACTORILY INSPECTED VISUALLY, AN INFILTRATION OR EXFILTRATION TEST SHALL BE PERFORMED.

3.2.4 INFILTRATION/EXFILTRATION RATES SHALL BE DETERMINED ON THE MAIN SEWER AND LATERALS AND SHALL BE WITHIN THE ALLOWABLE RATE AS SPECIFIED. ALL WYES, TEES AND OTHER FITTINGS IN THE MAIN SEWER LINE AND LATERALS SHALL BE ADEQUATELY CAPPED OR PLUGGED TO WITHSTAND THE MAXIMUM ANTICIPATED HEAD DURING EXFILTRATION TESTING AND TO PREVENT DEBRIS, GROUNDWATER, ETC. FROM ENTERING DURING INFILTRATION TESTING. ALL CAPS OR PLUGS WHICH "BLOW-OUT" OR LEAK SHALL BE REPLACED AS OFTEN AS NECESSARY BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE OWNER UNTIL THE MAIN SEWER PASSES THE INFILTRATION/EXFILTRATION TEST. ALL SEWERS NOT IN COMPLIANCE WITH THESE REQUIREMENTS SHALL BE CORRECTED BY THE CONTRACTOR UNTIL SUCH TIME AS THE RATE CAN BE MET. SUCH CORRECTIONS AS NECESSARY SHALL BE MADE BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE OWNER.

3.2.5 WHEN PERFORMING AN INFILTRATION TEST, THE CONTRACTOR SHALL BLOCK OFF A SECTION OF THE SYSTEM NOT EXCEEDING 1000 LINEAR FEET, AND INSTALL A MEASURING DEVICE AT THE DOWNSTREAM END OF THE TEST SECTION. INFILTRATION SHALL NOT EXCEED THE ALLOWABLE AMOUNT SPECIFIED. IF THE ACTUAL INFILTRATION EXCEEDS THE ALLOWABLE INFILTRATION OR IF THERE ARE VISIBLE SIGNS OF INFILTRATION SUCH AS GUSHING OR SPURTING STREAMS, THE CONTRACTOR SHALL EFFECT ALL REPAIRS NECESSARY TO MAKE THE PIPE SUFFICIENTLY WATERTIGHT. THE SECTION SHALL BE RETESTED UNTIL THE RATE OF ALLOWABLE INFILTRATION IS MET.

3.2.6 THE WATER EXFILTRATION TEST SHALL BE PERFORMED BETWEEN CONSECUTIVE MANHOLES. AFTER WATER HAS BEEN INTRODUCED INTO THE SECTION AND ALL AIR EXPELLED, A STABILIZATION PERIOD SHALL BE ALLOWED FOR ABSORPTION OF WATER. THE WATER LEVEL SHALL THEN BE RAISED TO TWO FEET ABOVE THE GROUND WATER LEVEL, BUT IN NO CASE SHALL THE TEST WATER LEVEL BE LESS THAN TWO FEET ABOVE THE TOP OF THE PIPE AT THE UPSTREAM MANHOLE. THE QUANTITY OF WATER REQUIRED TO MAINTAIN THIS LEVEL OVER A FORTY-EIGHT HOUR PERIOD SHALL BE MEASURED. EXFILTRATION SHALL NOT EXCEED THE ALLOWABLE AS SPECIFIED. IF THE ACTUAL EXFILTRATION EXCEEDS THE ALLOWABLE EXFILTRATION OR IF THERE ARE VISIBLE SIGNS OF EXFILTRATION FROM THE PIPE, THE CONTRACTOR SHALL EFFECT ALL REPAIRS NECESSARY TO MAKE THE PIPE SUFFICIENTLY WATERTIGHT. THE SECTION SHALL BE RETESTED UNTIL THE RATE OF ALLOWABLE EXFILTRATION IS MET.

3.2.7 AIR TESTING MAY BE USED INSTEAD OF THE WATER EXFILTRATION TEST TO MEASURE EXFILTRATION. THE SECTION TO BE TESTED SHALL BE BETWEEN CONSECUTIVE MANHOLES. EACH END OF PIPE, ALL BRANCHES, LATERALS, AND WYES SHALL BE PLUGGED AND SECURELY BRACED. THE PLUG AT EACH END OF PIPE SHALL HAVE PROVISION TO CONNECT AN AIR HOSE. AIR SHALL BE SUPPLIED TO THE SECTION AND MONITORED SO AS NOT TO EXCEED 5.0 PSIG. AN INDEPENDANT AIR GAGE AND LINE SHALL BE INSTALLED ON THE OPPOSITE PLUG TO THE AIR SUPPLY SUCH THAT THE GAGE CAN BE READ AT THE GROUND SURFACE. THE AIR PRESSURE SHALL BE MAINTAINED BETWEEN 4.0 AND 3.5 PSIG. FOR AT LEAST TWO MINUTES TO ALLOW AIR TEMPERATURE TO COME TO EQUILIBRIUM WITH PIPE WALLS. THE AIR SUPPLY SHALL THEN BE DISCONNECTED AND THE AIR PRESSURE ALLOWED

TO DECREASE TO 3.5 PSIG. AT 3.5 PSIG THE TIME SHALL BE MEASURED FOR THE PRESSURE TO DROP TO 2.5 PSIG. THE FOLLOWING TABLE SHOWS THE ALLOWABLE TIME FOR A LOSS OF 1.0 PSIG AT AN AVERAGE PRESSURE OF 3.0 PSIG.

<u>PIPE SIZE-INCHES</u>	<u>ALLOWABLE TIME IN MINUTES-SECONDS</u>
4	2 - 15
6	2 - 15
8	3 - 57
10	4 - 43
12	5 - 40
15	7 - 05
18	8 - 30
20	9 - 50
24	11 - 20
27	12 - 45
30	14 - 10
33	15 - 50
36	17 - 00
42	19 - 50
48	22 - 40
54	25 - 30
60	28 - 20
66	31 - 10
72	34 - 00
84	39 - 40
96	47 - 00
108	51 - 00

IF THE ACTUAL TIME FOR A LOSS 1.0 PSIG IS LESS THAN THE ALLOWABLE TIME SHOWN IN THE ABOVE TABLE THE CONTRACTOR SHALL DETERMINE THE

SOURCE OF LEAKAGE AND EFFECT ALL REPAIRS NECESSARY TO MAKE THE PIPE SUFFICIENTLY AIRTIGHT. THE SECTION SHALL BE RETESTED UNTIL THE ALLOWABLE TIME IS MET OR EXCEEDED.

3.2.8 PIPES INSTALLED AT SLOPES LESS THAN THOSE SHOWN ON THE DRAWINGS SHALL BE RE-INSTALLED TO THE SLOPES AS SHOWN OR THE CONTRACTOR SHALL PROVIDE A DESIGN REPORT PREPARED AND SEALED BY A PROFESSIONAL ENGINEER SHOWING THE THEORETICAL CAPACITY AND VELOCITY OF THE PIPE "AS INSTALLED" BASED ON TOTAL ENERGY HEAD AND THE PIPE MANUFACTURER'S "N" VALUE. THE THEORETICAL "AS INSTALLED" VELOCITIES AND CAPACITIES SHALL BE SUBMITTED TO THE ENGINEER FOR EVALUATION. IF THE "AS INSTALLED" THEORETICAL CAPACITY AND VELOCITY MEET THE DESIGN REQUIREMENTS THE LINE WILL BE ACCEPTABLE.

3.2.8.1 IF THE "AS INSTALLED" THEORETICAL CAPACITY AND VELOCITY DO NOT MEET THE DESIGN REQUIREMENTS THE CONTRACTOR SHALL CONDUCT A FLOW TEST TO DETERMINE THE VELOCITY AND CAPACITY WITH THE PIPE FLOWING ONE-HALF FULL. IF THE ACTUAL VELOCITY AND CAPACITY MEET THE DESIGN REQUIREMENT THE LINE IS ACCEPTABLE, OTHERWISE THE LINE SHALL BE RELAID TO THE SLOPE AS SHOWN ON THE DRAWINGS.

PART ONE - GENERAL

1.1 SECTION INCLUDES

1.1.1 REQUIREMENTS FOR PROVIDING SLUICE GATES AND OPERATORS.

1.2 SYSTEM DESCRIPTION

1.2.1 SLUICE GATES SHALL BE USED TO CONTROL THE FLOW OF WASTEWATER.

1.2.2 SLUICE GATES SHALL CONFORM TO AWWA C501 AS AMENDED HEREIN.

1.2.3 EACH SLUICE GATE SHALL BE SUPPLIED WITH A REMOVABLE HAND CRANK OPERATOR. ONE PORTABLE MOTOR OPERATOR SHALL ALSO BE PROVIDED WHICH CONNECTS TO THE OPERATING NUT OF THE HAND CRANK.

1.2.4 SLUICE GATES AND OPERATORS SHALL OPERATE AT 20 FEET OF SEATING AND UNSEATING HEAD. (MEASURED FROM WATER SURFACE TO CENTER LINE OF CONNECTED PIPE.)

1.2.5 OPTIONAL CONSTRUCTION FOR REINFORCED PLASTIC GATES ARE INDICATED HEREIN. THE REINFORCED PLASTIC GATES SHALL BE PROVIDED WITH ALL OPTIONS INDICATED.

1.2.6 LEAKAGE SHALL NOT EXCEED 0.1 GPM PER FOOT OF SEATING PERIMETER AT SEATING HEAD AND 0.2 GPM PER FOOT OF SEATING PERIMETER AT UNSEATING HEAD.

1.3 QUALITY ASSURANCE

1.3.1 SLUICE GATES SUPPLIED SHALL BE MADE BY A MANUFACTURER REGULARLY ENGAGED IN SUCH WORK.

1.3.2 ALL SLUICE GATES AND OPERATORS SHALL BE SUPPLIED BY THE SAME MANUFACTURER.

1.4 REFERENCES

1.4.1 AWWA C501 - STANDARD FOR SLUICE GATES

1.4.2 ASTM A 126 CLASS B - SPECIFICATIONS FOR GREY IRON CASTINGS FOR VALVES, FLANGES AND PIPE FITTINGS

1.4.3 ASTM B 139 ALLOY A - SPECIFICATIONS FOR PHOSPHOR, BRONZE ROD, BAR, AND SHAPES

1.4.4 ASTM B 584 ALLOY 12A - SPECIFICATIONS FOR COPPER ALLOY SAND CASTINGS FOR GENERAL APPLICATIONS

1.4.5 ASTM A 276 - SPECIFICATIONS FOR STAINLESS AND HEAT-RESISTING STEEL BARS AND SHAPES

1.5 SUBMITTALS

1.5.1 SHOP DRAWINGS SHALL BE SUBMITTED AS SPECIFIED IN THE SPECIFICATION AND SHALL INCLUDE THE FOLLOWING:

1.5.1.1 WEIGHT OF THE GATE, SIZE OF STEM, A SCHEDULE OF PARTS AND MATERIALS ALONG WITH ALL OTHER INFORMATION NECESSARY FOR CONSTRUCTION AND ERECTION PURPOSES.

PART TWO - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

2.1.1 SLUICE GATES SHALL BE AS MANUFACTURED BY RODNEY HUNT; WATERMAN INDUSTRIES; OR EQUAL.

2.2 MATERIALS

2.2.1 MATERIALS FOR SLUICE GATES SHALL CONFORM TO THE FOLLOWING SPECIFICATIONS:

2.2.1.1 FRAME - CAST IRON, ASTM A 126 CLASS B. (OPTIONAL: CARBON STEEL FLAME ZINC SPRAYED 4 TO 6 MILS AND EPOXY COATED (MIN. 14 MILS OFT) OR 316 L STAINLESS STEEL.)

2.2.1.2 SLIDE - CAST IRON, ASTM A 126 CLASS B. (OPTIONAL: REINFORCED PLASTIC)

2.2.1.3 GUIDES - CAST IRON, ASTM A 126 CLASS B.

2.2.1.4 SEATS - BRONZE, ASTM B 139 ALLOY A. (OPTIONAL: UHMW POLYETHYLENE, HIGH DENSITY POLYOLEFIN.)

2.2.1.5 WEDGES, COUPLINGS, BUSHINGS - BRONZE, ASTM B 584 ALLOY 12A.

2.2.1.6 STEMS - 304 STAINLESS STEEL, ASTM A 276.

2.2.1.7 WALL THIMBLE - CAST IRON, ASTM A 126 CLASS B.

2.2.1.8 FASTENERS - 304 STAINLESS STEEL, ASTM A 276.

2.2.2 MATERIALS OF CONSTRUCTION FOR THE SLUICE GATE OPERATORS SHALL CONFORM TO AWWA C501.

2.3 EQUIPMENT

2.3.1 FRAME

2.3.1.1 THE FRAME SHALL BE ONE-PIECE CONSTRUCTION OF FLANGED OR FLAT TYPE WITH RECTANGULAR OR CIRCULAR OPENING AS SHOWN ON THE DRAWINGS. ALL CONTACT SURFACES OF THE FRAME WILL BE MACHINED. THE FRAME WILL HAVE MACHINED DOVE-TAILED GROOVES ON THE FRONT FACE INTO WHICH BRONZE SEAT FACINGS SHALL BE DRIVEN AND MACHINED TO A 63 MICRO-INCH FINISH. THE BACK FLANGE OF THE

FRAME SHALL BE MACHINED TO BOLT DIRECTLY TO THE MACHINED FACE OF A WALL THIMBLE. FRAMES FOR THE SLUICE GATES SUBJECT TO UNSEATING HEADS SHALL HAVE INTEGRALLY CAST PADS MACHINED WITH KEYWAYS TO RECEIVE TOP AND BOTTOM WEDGE SEATS.

2.3.2 SLIDE

2.3.2.1 THE SLIDE SHALL BE ONE-PIECE CONSTRUCTION, RECTANGULAR WITH INTEGRALLY CAST VERTICAL AND HORIZONTAL RIBS. A REINFORCING RIB ALONG EACH SIDE SHALL BE PROVIDED TO INSURE RIGIDITY BETWEEN THE SIDE WEDGES. THE SLIDE SHALL HAVE MACHINED-DOVE-TAILED GROOVES ON THE SEATING FACE INTO WHICH BRONZE SEAT FACINGS SHALL BE DRIVEN AND MACHINED TO A 63 MICRO-INCH FINISH. A TONGUE ON EACH SIDE, EXTENDING THE FULL LENGTH OF THE SLIDE, SHALL BE MACHINED ON ALL SIDES WITH A 1/16-INCH CLEARANCE MAINTAINED BETWEEN THE SLIDE TONGUE AND THE GATE GUIDE GROOVE. WEDGE PADS FOR SIDE WEDGES, AND FOR TOP AND BOTTOM WEDGES WHEN REQUIRED, SHALL BE CAST INTEGRALLY ON THE SLIDE AND MACHINED TO RECEIVE THE ADJUSTABLE BRONZE WEDGES. THE SIDE WEDGE PADS SHALL BE LOCATED AT THE ENDS OF HORIZONTAL RIBS. A HEAVILY REINFORCED NUT POCKET SHALL BE CAST INTEGRALLY ON THE VERTICAL CENTERLINE AND ABOVE THE HORIZONTAL CENTER AND BE OF SUCH SHAPE TO RECEIVE THE STEM ATTACHMENT FOR THRUST IN EACH DIRECTION.

(OPTIONAL SLIDE: SLIDE (DISC) SHALL BE CONSTRUCTED FROM A REINFORCED RIGID COMPOSITE PLASTIC MATERIAL, HAVING A MINIMUM THICKNESS OF 1/8 INCH. SLIDE (DISC) SHALL HAVE INTERNAL MATRIX OF CARBON STEEL OF SUITABLE STRENGTH FOR THE SPECIFIED SERVICE. THE SLIDE (DISC) OUTER SURFACE SKINS SHALL BE A HOMOGENEOUS PLASTIC MATERIAL HAVING EXTREMELY HIGH TENSILE AND IMPACT STRENGTH, BE NONTOXIC AND SHALL BE STABILIZED AGAINST ULTRAVIOLET LIGHT. THE PLASTIC MATERIAL SHALL BE AN ARAMID FIBER FROM THE KEVLAR FAMILY OF FIBERS, AND HAVE THE FOLLOWING MINIMUM PROPERTIES:

PROPERTIES TABLE

TENSILE STRENGTH	12,500 PSI
YOUNG'S MODULUS	1,200,000 PSI
FLEXURAL STRENGTH	18,000 PSI
FLEXURAL MODULUS	1,400,000 PSI
COMPRESSIVE STRENGTH	11,000 PSI
IMPACT STRENGTH	40.3 X 1,000,000 ERG
WATER ABSORPTION	0.38%
SPECIFIC GRAVITY	1.72
COEFFICIENT OF THERMAL EXPANSION	0.000016 PER C
HEAT DISTORTION POINT	80 DEGREES C ASTM D648
LOW TEMPERATURE IMPACT STRENGTH	93% @ -20C
NOTCH SENSITIVITY	NOT NOTCH SENSITIVE
WEATHERING PROPERTIES	EXCELLENT

FIRE RESISTANCE

CLASS 1 SPREAD OF FLAME,
RATING BS476: PART 1: 1953
SELF-EXTINGUISHING,
ASTM D635 - 56R
ORGANICS, ALKALINES, OZONE
(2 TO 3 PPM)

CHEMICAL RESISTANCE

RIGID POLYURETHANE FOAM SHALL BE USED AS FILLER BETWEEN THE STEEL GRID REINFORCING SYSTEM AND SHALL BE A MINIMUM OF 7 LB DENSITY PER CUBIC FOOT. THE GATE SHALL BE DESIGNED TO LIMIT THE DEFLECTION TO A MAXIMUM OF 1/1000 OF THE SPAN UNDER DESIGN HEAD CONDITIONS BASED UPON HORIZONTAL SUPPORT MEMBERS ONLY. THE CONTRACTOR SHALL SUBMIT DRAWINGS AND COMPREHENSIVE DESIGN CRITERIA FROM MANUFACTURER TO SUBSTANTIATE THAT THE REQUIRED DEFLECTION FIGURE HAS BEEN ACHIEVED. COMPREHENSIVE SAFETY FACTOR CALCULATION SHALL INCLUDE BENDING MOMENTS, BUCKLING STRESS, BONDING STRESS WITH THERMAL EXPANSION FACTORS. SAFETY FACTORS SHALL BE CALCULATED FOR THE DISC UNDER MAXIMUM HEAD, AND SHEAR AT THE DISC/SEAL INTERFACE.)

2.3.2.2 THE GUIDES SHALL BE ONE-PIECE, DESIGNED TO WITHSTAND, THE TOTAL THRUST DUE TO THE WATER PRESSURE AND THE WEDGING ACTION. THE GUIDES SHALL BE MACHINED ON ALL CONTACT SURFACES AND A GROOVE SHALL BE MACHINED THE ENTIRE LENGTH OF THE GUIDE TO ALLOW 1/16-INCH CLEARANCE BETWEEN THE SLIDE TONGUE AND THE GUIDE GROOVE. THE GUIDES SHALL BE OF SUCH LENGTH AS TO RETAIN AND SUPPORT AT LEAST 1/2 THE SLIDE IN THE FULL OPEN POSITION. THE GUIDES SHALL BE ATTACHED TO THE FRAME WITH SILICON BRONZE OR STAINLESS STEEL STUDS AND NUTS AND SHALL BE DOWELLED TO PREVENT ANY RELATIVE MOTION BETWEEN THE GUIDES AND THE FRAME.

2.3.3 SEATS

2.3.3.1 SEAT FACINGS SHALL BE OF A SPECIAL SHAPE TO FILL AND PERMANENTLY LOCK IN THE MACHINED DOVE-TAIL GROOVES WHEN PNEUMATICALLY IMPACTED INTO PLACE, ATTACHING PINS AND SCREWS SHALL NOT BE ALLOWED. THE INSTALLED SEAT FACINGS SHALL BE MACHINED TO A 63 MICRO-INCH FINISH OR BETTER.

(OPTIONAL SEATS/SEALS: THE SEALING ARRANGEMENT FOR THE REINFORCED PLASTIC SLUICE GATES SHALL COMPRISE OF SEALING FACES AND SIDE GUIDES CONSTRUCTED OF ULTRA HIGH MOLECULAR WEIGHT POLYOLIFIN HAVING AN EXTREMELY LOW COEFFICIENT OF FRICTION AND BACKING CONSTRUCTED OF HIGHLY RESILIENT EXPANDED NEOPRENE. GUIDES AND SEATING OF THE GATE SHALL BE EASILY ADJUSTABLE (MINIMUM 5/8 INCHES). ALL MOVING CONTACT SURFACES SHALL BE INCOMPATIBLE TO EACH OTHER THEREBY MINIMIZING STICKING/JAMMING AND MAKING THE OPERATION EASY. LEAKAGE RATES SHALL BE 1/2 AS ALLOWED BY AWWA C501.)

2.3.4 WEDGES

2.3.4.1 WEDGES SHALL BE SOLID AND MACHINED ON ALL CONTACT SURFACES. THEY SHALL BE ATTACHED TO THE SLIDE WITH STUDS AND NUTS AND SHALL HAVE ADJUSTING SCREWS WITH LOCK NUTS. BOLTED-ON WEDGE SEATS SHALL NOT BE ALLOWED. WEDGE SEATS SHALL BE SECURELY ATTACHED TO MACHINED PADS ON THE GUIDES.

2.3.5 STEMS AND STEM GUIDES

2.3.5.1 THE OPERATING STEM SHALL BE OF A SIZE TO SAFELY WITHSTAND, WITHOUT BUCKLING OR PERMANENT DISTORTION, THE STRESSES INDUCED BY NORMAL OPERATING FORCES. THE STEM WILL BE DESIGNED TO TRANSMIT IN COMPRESSION AT LEAST TWO TIMES THE RATED OUTPUT OF THE FLOOR-STAND OR BENCHSTAND WITH A 40 POUND EFFORT ON THE CRANK OR HANDWHEEL. THE THREADED PORTION OF THE STEM SHALL HAVE MACHINED CUT THREADS OF THE ACME TYPE OR OF THE ROLLED TYPE. STEMS OF MORE THAN ONE SECTION SHALL BE JOINED BY COUPLINGS THREADED AND KEYED TO THE STEMS. ALL THREADED AND KEYED COUPLINGS OF THE SAME SIZE SHALL BE INTERCHANGEABLE. MANUALLY OPERATED, RISING STEM GATES WILL BE PROVIDED WITH AN ADJUSTABLE CAST IRON STOP COLLAR ON THE STEM ABOVE THE FLOOR AND LIFT NUT. STEM GUIDES SHALL BE ADJUSTABLE IN TWO DIRECTIONS AND SHALL BE SPACED AT INTERVALS TO ADEQUATELY SUPPORT THE STEM. STEM GUIDE SPACING SHALL NOT EXCEED 10 FEET, OR AN L/R RATIO OF 200.

2.3.6 WALL THIMBLES

2.3.6.1 WALL THIMBLES SHALL BE FURNISHED BY THE SLUICE GATE MANUFACTURER AND SHALL BE OF THE TYPE INDICATED ON THE DRAWINGS.

2.3.6.2 WALL THIMBLES SHALL BE ONE PIECE CONSTRUCTION. THE CASTINGS SHALL BE ADEQUATE TO WITHSTAND ALL OPERATIONAL AND INSTALLATION STRESSES. A CENTER RING OR WATER STOP SHALL BE CAST AROUND THE PERIPHERY OF THE CASTING. THE FRONT FLANGE SHALL BE MACHINED AND HAVE TAPPED HOLES FOR THE SLUICE GATE ATTACHING STUDS AND METAL STAMPED VERTICAL CENTERLINES WITH THE WORD "TOP" FOR CORRECT ALIGNMENT. THE OPPOSITE END OF THE WALL THIMBLES SHALL BE MACHINED TO PROVIDE THE EXACT DEPTH REQUIRED. LARGE RECTANGULAR WALL THIMBLES SHALL BE PROVIDED WITH HOLES IN THE INVERT TO ALLOW SATISFACTORY CONCRETE PLACEMENT BENEATH THE THIMBLE. A PERMANENT GASKET OF UNIFORM THICKNESS SHALL BE PROVIDED BETWEEN THE SLUICE GATE AND THE WALL THIMBLE.

2.3.7 OPERATORS

2.3.7.1 MANUAL OPERATIONS SHALL BE BY CRANK OPERATORS MOUNTED ON A FLOORSTAND. CRANK-OPERATED TYPE SHALL HAVE EITHER SINGLE OR DOUBLE GEAR REDUCTION DEPENDING UPON THE LIFTING CAPACITY REQUIRED. EACH TYPE SHALL BE PROVIDED WITH A THREADED CAST BRONZE LIFT NUT TO ENGAGE THE OPERATING STEM. TAPERED ROLLER BEARINGS OR BALL BEARINGS SHALL BE PROVIDED ABOVE AND BELOW A FLANGE ON THE OPERATING NUT TO SUPPORT BOTH OPENING AND CLOSING THRUSTS. OPERATORS SHALL RAISE AND LOWER THE GATES UNDER THE SPECIFIED OPERATING HEAD WITH NOT GREATER THAN A 40 POUND PULL ON THE CRANK. GEARS, WHERE REQUIRED, SHALL BE STEEL WITH MACHINED CUT TEETH DESIGNED FOR SMOOTH OPERATION. THE PINION SHAFTS ON CRANK OPERATED FLOORSTANDS, EITHER SINGLE OR DOUBLE RATIO, SHALL BE SUPPORTED ON BALL BEARINGS, TAPERED ROLLER BEARINGS, OR NEEDLE BEARINGS. ALL COMPONENTS SHALL BE TOTALLY ENCLOSED IN A CAST IRON CASE AND COVER. POSITIVE MECHANICAL SEALS WILL BE PROVIDED ON THE

OPERATING NUT AND THE PINION SHAFTS TO EXCLUDE MOISTURE AND DIRT AND PREVENT LEAKAGE OF LUBRICANT OUT OF THE HOIST. LUBRICATING FITTINGS SHALL BE PROVIDED FOR THE LUBRICATION OF ALL GEARS AND BEARINGS. REMOVABLE CRANK SHALL BE DESIGNED FOR ROUGH TREATMENT AND MINIMUM WEIGHT. FLOORSTANDS SHALL INCLUDE A CAST IRON PEDESTAL DESIGNED TO POSITION THE INPUT SHAFT APPROXIMATELY 36 INCHES ABOVE THE OPERATING FLOOR. AN ARROW WITH THE WORK "OPEN" WILL BE PERMANENTLY ATTACHED OR CAST ON THE FLOORSTAND, INDICATING THE DIRECTION OF ROTATION TO OPEN THE GATE. ALL CRANK HOISTING EQUIPMENT SHALL BE CAPABLE OF ALSO BEING OPERATED BY A PORTABLE ELECTRIC OPERATOR.

2.3.7.2 A STEEL PIPE COVER WITH STEM INDICATION AND MOUNTING ADAPTER SHALL BE FURNISHED FOR EACH OPERATOR. STEM COVER SHALL HAVE TOP AND BOTTOM VENT HOLES TO PREVENT CONDENSATION ON THE INSIDE. COVERS SHALL BE EASILY REMOVABLE FOR PERIODIC STEM INSPECTION, CLEANING AND LUBRICATION.

2.3.7.3 THE PORTABLE MOTOR OPERATOR SHALL BE FURNISHED COMPLETE WITH MOTOR, GEARING, TORQUE LIMITING CLUTCH, AND CONTROL UNIT. THE UNIT SHALL BE MOUNTED ON A TRIPOD WITH ADJUSTABLE HEIGHT. MOTOR SHALL OPERATE ON 110 VOLT, SINGLE PHASE, 60 HZ CURRENT.

2.3.7.4 THE SPEED OF OPERATION WITH THE MOTOR OPERATOR SHALL BE APPROXIMATELY ONE FOOT PER MINUTE.

2.4 FACTORY PAINTING

2.4.1 SLUICE GATES AND OPERATORS SHALL BE COATED AT THE PLACE OF MANUFACTURE. MATERIALS AND THICKNESSES FOR COATINGS SHALL BE AS RECOMMENDED BY THE MANUFACTURER FOR EXPOSURE TO THE SEWER ENVIRONMENT.

PART THREE - EXECUTION

3.1 FIELD PAINTING

3.1.1 SLUICE GATE COATING SHALL BE TOUCHED UP IN THE FIELD.

3.2 PREPARATION

3.2.1 ALL SLUICE GATES SHALL BE STORED ON TIMBER SLEEPERS AND COVERED WITH A TARPAULIN UNTIL INSTALLATION.

3.2.2 STEM THREADS SHALL BE GREASED AND COVERED AT ALL TIMES.

3.3 INSTALLATION/APPLICATION/ERECTION

3.3.1 SLUICE GATES SHALL ONLY BE HOISTED DURING ERECTION BY THE LIFTING EYES ON THE FRAME.

3.3.2 INSTALLATION SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS. INSTALLATION SHALL INCLUDE FURNISHING THE NECESSARY OIL AND GREASE FOR INITIAL OPERATION. THE GRADES OF OIL AND GREASE SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS. ANCHOR BOLTS SHALL BE SET BY THE CONTRACTOR IN ACCORDANCE WITH THE SHOP DRAWINGS.

3.4 FIELD QUALITY CONTROL

3.4.1 THE EQUIPMENT SHALL BE OPERATED AND CHECKED FOR LEAKS, BINDING, MISALIGNMENT AND ANY MALFUNCTION THAT WOULD BE CAUSE FOR REJECTION OF THE OPERATORS.

3.4.2 ALL OPERATORS THAT ARE REJECTED ON THE BASIS OF FIELD TESTS SHALL BE RETURNED TO THE SHOP FOR REPAIR OR REPLACEMENT.

3.4.3 FOR THE FIELD TESTS THE GATE SHALL BE CLOSED, THE OUTLET PIPE PLUGGED AND CHAMBER FILLED WITH WATER. THE DROP IN WATER LEVEL AFTER TWO HOURS WILL BE MEASURED AND THE VOLUME CALCULATED TO COMPARE WITH THE ALLOWABLE LEAKAGE. NO TEST WATER SHALL BE DISCHARGED/FLUSHED INTO THE ACTIVE SEWERAGE.